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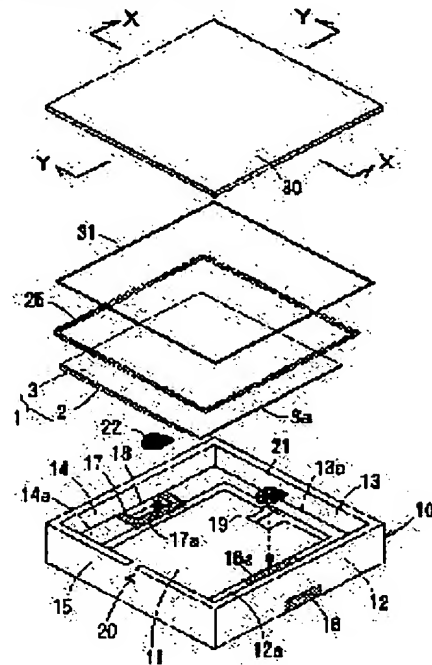
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## (54) PIEZOELECTRIC ACOUSTIC PART AND METHOD FOR MANUFACTURING THE SAME

## (57)Abstract:

PROBLEM TO BE SOLVED: To provide a piezoelectric acoustic parts capable of improving connection reliability by directly connecting a case conducting part and a diaphragm, without a conductive adhesive straddling over insulation material.

SOLUTION: In these piezoelectric acoustic parts, a square diaphragm 1 is housed in and fixed to an insulation case 10, and the opening part of the case 10 is closed by a cover plate 30. Two facing sides of the case 10 are provided with support parts 12a and 14a and have first and second conducting parts 16 and 17, extracted from the upper face of the support parts. The diaphragm 1 is housed in the case 10, so as to make its piezoelectric plate 2 face the bottom wall part 11 side of the case 10, an exposure part 3a of a metal plate 3 is connected to the first conducting part 16 by a conductive adhesive 21 facing each other, and the electrode of the other face of the plate 2 is connected to the second conducting part 17 by a second conductive adhesive 22, facing each other.



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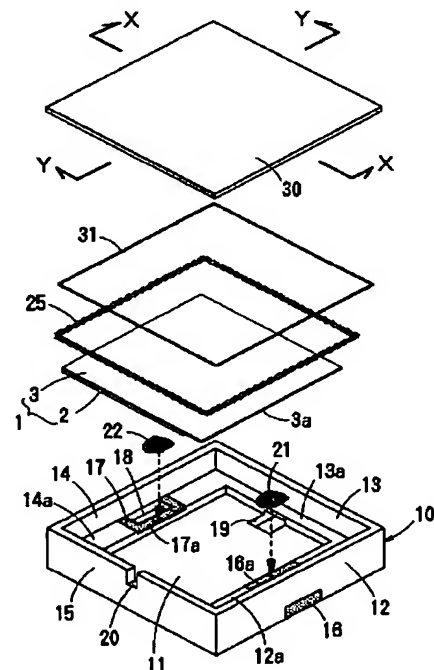
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(54) 【発明の名称】 圧電音響部品およびその製造方法

(57) 【要約】 (修正有)

【課題】 導電性接着剤が絶縁材を跨ぐことなく、ケースの導電部と振動板とを直接接続して接合信頼性を高めることができる圧電音響部品を提供する。

【解決手段】 圧電音響部品は、絶縁性ケース 10 に四角形の振動板 1 を収納固定し、ケース 10 の開口部を蓋板 30 で閉じた構造を有する。ケース 10 の対向する 2 辺には支持部 12a, 14a が設けられ、この支持部の上面から外部へ引き出された第 1, 第 2 の導電部 16, 17 を有する。振動板 1 は、その圧電板 2 がケース 10 の底壁部 11 側を向くようにケース 10 に収納され、金属板 3 の露出部 3a と第 1 の導電部 16 とが第 1 の導電性接着剤 21 により対面して接続され、圧電板 2 の他面電極と第 2 の導電部 17 とが第 2 の導電性接着剤 22 により対面して接続される。



## 【特許請求の範囲】

【請求項 1】底壁部と 4 つの側壁部とを有し、対向する 2 つの側壁部の内側に支持部を持ち、上記支持部の上面から外部へ引き出された第 1、第 2 の導電部を有する絶縁性ケースと、上記ケース内に収納されるとともに、対向する 2 辺が上記支持部に固定され、残りの 2 辺とケースとの隙間が封止された四角形の振動板と、上記ケースの開口部を閉じる蓋板とを備え、上記振動板は、金属板の片面に圧電板の片面電極が、ケースの支持部に固定される 2 辺のうちの 1 辺側に偏った位置に接着され、圧電板が接着された金属板の面の他辺側に金属板の一部が露出する露出部が設けられ、この露出部と第 1 の導電部とが第 1 の導電性接着剤により接続され、圧電板の他面電極と第 2 の導電部とが第 2 の導電性接着剤により接続された圧電音響部品において、上記振動板は、その圧電板がケースの底壁部を向くようにケースに収納されており、上記金属板の露出部と第 1 の導電部とが第 1 の導電性接着剤により対面して接続され、圧電板の他面電極と第 2 の導電部とが第 2 の導電性接着剤により対面して接続されていることを特徴とする圧電音響部品。

【請求項 2】上記支持部上に設けられた第 2 の導電部は上記振動板の端面より内側に位置しており、上記第 2 の導電部に隣接して、余剰の第 2 の導電性接着剤を逃がすための凹部が設けられていることを特徴とする請求項 1 に記載の圧電音響部品。

【請求項 3】上記振動板の対向する 2 辺が支持部に弾性封止材で固定されるとともに、残りの 2 辺とケースとの隙間が弾性封止材で封止されていることを特徴とする請求項 1 または 2 に記載の圧電音響部品。

【請求項 4】上記第 1、第 2 の導電部は、ケースにインサートモールドされた金属端子で構成されていることを特徴とする請求項 1 ないし 3 のいずれかに記載の圧電音響部品。

【請求項 5】底壁部と 4 つの側壁部とを有し、対向する 2 つの側壁部の内側に支持部を持ち、上記支持部の上面から外部へ引き出された第 1、第 2 の導電部を有する絶縁性ケースを準備する工程と、金属板の片面に圧電板の片面電極が、対向する 2 辺のうちの 1 辺側に偏った位置に接着され、圧電板が接着された金属板の面の他辺側に金属板の一部が露出する露出部が設けられた四角形の振動板を準備する工程と、蓋板を準備する工程と、第 1 の導電部および第 2 の導電部の上、または金属板の露出部および圧電板の他面電極の上にそれぞれ第 1 および第 2 の導電性接着剤を塗布する工程と、上記振動板をその圧電板がケースの底壁側を向くように、かつ金属板の露出部および圧電板の他面電極がそれぞれ第 1 の導電部および第 2 の導電部に対応するようにケース内に収納し、金属板の露出部と第 1 の導電部とを第 1 の導電性接着剤により対面接続するとともに、圧電板の他面電極と第 2 の導電部とを第 2 の導電性接着剤により対面接続する工程

と、上記振動板の金属板の露出部とこれと対向する振動板の辺とを上記支持部に固定する工程と、上記振動板の残りの 2 辺をケースに対して封止する工程と、上記ケースの開口部に蓋板を固定する工程と、を備える圧電音響部品の製造方法。

【請求項 6】上記ケースの第 2 の導電部に隣接して余剰の第 2 の導電性接着剤を逃がすための凹部が設けられ、上記圧電板の他面電極と第 2 の導電部とを第 2 の導電性接着剤により接続する際、余剰の第 2 の導電性接着剤を上記凹部に逃がすことを特徴とする請求項 5 に記載の圧電音響部品の製造方法。

【請求項 7】上記第 1、第 2 の導電性接着剤は第 1 の導電部および第 2 の導電部の上にそれぞれ塗布され、上記振動板をケース内に収納した際に、金属板の露出部と圧電板の他面電極とを導電性接着剤が塗布された第 1 と第 2 の導電部にそれぞれ押し付けることにより、金属板の露出部と第 1 の導電部とを接続し、圧電板の他面電極と第 2 の導電部とを接続することを特徴とする請求項 5 または 6 に記載の圧電音響部品の製造方法。

【請求項 8】上記第 1 および第 2 の導電性接着剤と、上記振動板をケースに対して固定または封止するための絶縁性接着剤または弾性封止材とを、同時に硬化させる工程を含むことを特徴とする請求項 5 ないし 7 のいずれかに記載の圧電音響部品の製造方法。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は圧電ブザーや圧電受話器などの圧電音響部品およびその製造方法に関するものである。

## 【0002】

【従来の技術】従来、電子機器、家電製品、携帯電話機などにおいて、警報音や動作音を発生する圧電ブザーあるいは圧電受話器として圧電音響部品が広く用いられている。この種の圧電音響部品は、円形の金属板の片面に円形の圧電板を貼り付けてユニモルフ型振動板を構成し、金属板の周縁部を円形のケースの中にシリコンゴムを用いて支持するとともに、ケースの開口部をカバー（図示せず）で閉鎖した構造のものが一般的である。しかしながら、円形の振動板を用いると、生産効率が悪く、音響変換効率が低く、しかも小型に構成することが難しいという問題点があった。

【0003】そこで、四角形の振動板を用いることで、生産効率の向上、音響変換効率の向上および小型化を可能とした圧電音響部品が提案されている（特開 2000-310990 号公報）。図 13 は従来の圧電音響部品の一例を示し、四角形の金属板 61 の片面に四角形の圧電板 62 を貼り付けた振動板 60 と、底壁部 71 と 4 つの側壁部 72 とを有し、対向する 2 つの側壁部 72 の内側に支持部 73、74 を持つ絶縁性ケース 70 と、ケース 70 の開口部を閉じる蓋板 80 とを備えたものであ

る。ケース 70 内には振動板 60 がその金属板 61 をケース 70 の底壁部 71 側に向けて収納され、振動板 60 の対向する 2 辺と支持部 73, 74 とが接着剤または弾性封止材 90 で固定され、振動板 60 の残りの 2 辺とケース 70 との隙間が弾性封止材（図示せず）で封止されている。

【0004】上記圧電音響部品では、振動板 60 を構成する金属板 61 の少なくとも片面に表裏面に電極を有する圧電板 62 が、ケース 70 の支持部に固定される 2 辺のうちの 1 辺側（図 13 では右側）に偏った位置に接着され、金属板 61 の圧電板 62 が接着された面の他辺側に金属板 61 の一部 61a が露出している。ケース 70 の支持部 73, 74 には、その上面から外部へ引き出された第 1, 第 2 の導電部 75, 76 が形成されており、金属板 61 の露出部 61a と第 1 の導電部 75 とを導電性接着剤 91 により接続し、圧電板 62 の他面電極と第 2 の導電部 76 とを導電性接着剤 92 により接続することで、圧電音響部品を構成している。

【0005】

【発明が解決しようとする課題】ところが、第 2 の導電部 76 と接続される圧電板 62 の他面電極は、金属板 61 と近接しているため、導電性接着剤 92 により接続する際に金属板 61 と短絡しやすいという問題がある。そのため、上記圧電音響部品では、振動板 60 の金属板 61 をケース 70 の底壁部 71 側に向けて固定するとともに、金属板 61 を導電性接着剤 92 から絶縁するため、金属板 61 の端面を絶縁性の接着剤または封止材 90 で覆い、その上を跨ぐように導電性接着剤 92 を塗布することで、第 2 の導電部 76 と圧電板 62 の他面電極とを接続している。

【0006】しかし、上記のような接続方法では、導電性接着剤 92 が絶縁性の接着剤または封止材 90 の上を跨いで第 2 の導電部 76 と圧電板 62 の他面電極とを導通させる必要があるため、間接的な接続となり、接合信頼性に不安を残すという問題がある。特に、シリコンゴムのような封止材 90 の上に導電性接着剤 92 を塗布すると、封止材 90 と導電性接着剤 92 との固着強度が低いため、信頼性が低くなる。

【0007】そこで、本発明の目的は、導電性接着剤が絶縁材を跨ぐことなく、ケースの導電部と振動板とを直接接続して接合信頼性を高めることができる圧電音響部品を提供することにある。他の目的は、ケースの導電部と振動板とを簡単かつ確実に接続できる圧電音響部品の製造方法を提供することにある。

【0008】

【課題を解決するための手段】上記目的は請求項 1 または 5 に記載の発明によって達成される。請求項 1 に係る発明は、底壁部と 4 つの側壁部とを有し、対向する 2 つの側壁部の内側に支持部を持ち、上記支持部の上面から外部へ引き出された第 1, 第 2 の導電部を有する絶縁性

ケースと、上記ケース内に収納されるとともに、対向する 2 辺が上記支持部に固定され、残りの 2 辺とケースとの隙間が封止された四角形の振動板と、上記ケースの開口部を閉じる蓋板とを備え、上記振動板は、金属板の片面に圧電板の片面電極が、ケースの支持部に固定される 2 辺のうちの 1 辺側に偏った位置に接着され、圧電板が接着された金属板の面の他辺側に金属板の一部が露出する露出部が設けられ、この露出部と第 1 の導電部とが第 1 の導電性接着剤により接続され、圧電板の他面電極と第 2 の導電部とが第 2 の導電性接着剤により接続された圧電音響部品において、上記振動板は、その圧電板がケースの底壁部を向くようにケースに収納されており、上記金属板の露出部と第 1 の導電部とが第 1 の導電性接着剤により対面して接続され、圧電板の他面電極と第 2 の導電部とが第 2 の導電性接着剤により対面して接続されていることを特徴とする圧電音響部品を提供する。

【0009】また、請求項 5 に係る発明は、底壁部と 4 つの側壁部とを有し、対向する 2 つの側壁部の内側に支持部を持ち、上記支持部の上面から外部へ引き出された第 1, 第 2 の導電部を有する絶縁性ケースを準備する工程と、金属板の片面に圧電板の片面電極が、対向する 2 辺のうちの 1 辺側に偏った位置に接着され、圧電板が接着された金属板の面の他辺側に金属板の一部が露出する露出部が設けられた四角形の振動板を準備する工程と、蓋板を準備する工程と、第 1 の導電部および第 2 の導電部の上、または金属板の露出部および圧電板の他面電極の上にそれぞれ第 1 および第 2 の導電性接着剤を塗布する工程と、上記振動板をその圧電板がケースの底壁側を向くように、かつ金属板の露出部および圧電板の他面電極がそれぞれ第 1 の導電部および第 2 の導電部に対応するようにケース内に収納し、金属板の露出部と第 1 の導電部とを第 1 の導電性接着剤により対面接続するとともに、圧電板の他面電極と第 2 の導電部とを第 2 の導電性接着剤により対面接続する工程と、上記振動板の金属板の露出部とこれと対向する振動板の辺とを上記支持部に固定する工程と、上記振動板の残りの 2 辺をケースに対して封止する工程と、上記ケースの開口部に蓋板を固定する工程と、を備える圧電音響部品の製造方法を提供する。

【0010】請求項 1 に係る発明では、振動板として金属板の片面に圧電板が一方の辺側に偏った位置に接着されたユニモルフ型振動板を用いている。この振動板の対向する 2 辺を固定するケースの支持部には、外部へ引き出された第 1 の導電部と第 2 の導電部とが形成されている。振動板はその圧電板がケースの底壁部を向くようにケースに収納される。振動板をケース内に収納した際に、金属板の露出部と第 1 の導電部とが対面し、圧電板の他面電極と第 2 の導電部とが対面するので、その間に導電性接着剤を介在させることにより、金属板の露出部と第 1 の導電部とを確実に接続でき、圧電板の他面電極

と第2の導電部とを確実に接続できる。このように、第2の導電部と圧電板の他面電極とを絶縁材などを跨がずに直接対面接続することができるので、導電性接着剤による接合信頼性が向上する。

【0011】第2の導電部と圧電板の他面電極との間に必要量以上の導電性接着剤が介在していると、圧電板を第2の導電部に押しつけた時に余剰の導電性接着剤が振動板の端面に回り込んで、金属板と短絡する可能性がある。そこで、請求項2では、導電性接着剤の回り込みを防止するため、支持部上に設けられた第2の導電部を振動板の端面より内側に位置させ、第2の導電部に隣接して、余剰の第2の導電性接着剤を逃がすための凹部を設けてある。そのため、圧電板の他面電極を第2の導電部に押しつけた時、余剰の第2の導電性接着剤は凹部へ流れこみ、振動板の端面への導電性接着剤の回り込みを防止できる。その結果、圧電板の他面電極と金属板との短絡を防止でき、第2の導電部と圧電板の他面電極とを確実に接続することができる。

【0012】請求項3のように、振動板の対向する2辺を支持部に弾性封止材で固定し、残りの2辺とケースとの隙間を弾性封止材で封止するのが望ましい。つまり、振動板の周囲全周を弾性封止材で封止することにより、空気漏れがなくなるとともに、音圧特性も向上する。また、1種類の弾性封止材によって振動板の固定と封止とを行うことができるので、振動板の固定、封止作業が簡単になる。

【0013】請求項4のように、第1、第2の導電部を、ケースにインサートモールドされた金属端子で構成するのが望ましい。この場合には、外部電極を兼ねる導電部を簡単に形成することができる。

【0014】請求項5に係る発明では、第1の導電部および第2の導電部の上、または金属板の露出部および圧電板の他面電極の上にそれぞれ第1および第2の導電性接着剤を塗布し、振動板をその圧電板がケースの底壁側を向くようにケース内に収納し、金属板の露出部を第1の導電部に対して第1の導電性接着剤を介して押しつけるとともに、圧電板の他面電極を第2の導電部に対して第2の導電性接着剤を介して押しつける。そのため、金属板の露出部と第1の導電部、圧電板の他面電極と第2の導電部を簡単に対面接続することができる。その後、振動板の対向する2辺を支持部に固定し、振動板の残りの2辺をケースに対して封止すればよい。つまり、振動板と導電部とを電氣的に接続した後で、機械的な固定および封止を行うので、振動板と第1、第2の導電部との電氣的接続が固定および封止によって影響を受けず、信頼性が向上する。

【0015】請求項7のように、第1、第2の導電性接着剤を第1の導電部および第2の導電部の上にそれぞれ塗布しておき、金属板の露出部と圧電板の他面電極とを導電性接着剤が塗布された第1と第2の導電部にそれぞ

れ押し付けることにより、金属板の露出部と第1の導電部とを接続し、圧電板の他面電極と第2の導電部とを接続するのがよい。この場合には、導電性接着剤の塗布位置が一定するので、安定した接続が可能となる。

【0016】請求項8のように、第1および第2の導電性接着剤と、振動板をケースに対して固定または封止するための絶縁性接着剤または弾性封止材とを、同時に硬化させるのが望ましい。この場合には、振動板とケースとの固定または封止と、振動板と導電部との電氣的接続とを、少ない工程で行なうことができ、圧電音響部品を安価に製造することができる。

【0017】本発明の振動板は長さベンディングモードあるいは面積屈曲モードのいずれでも振動し得る。すなわち、振動板の対向する2辺をケースの支持部に固定し、残りの2辺とケースとの隙間を変位可能に封止した場合には、振動板はケースに固定された部分を節として上下に屈曲変形し、長さ方向の中央部が最大変位点となるように長さベンディングモードで振動する。また、振動板の4辺すべてをケースの支持部に固定した場合には、振動板の主面の対角線の交点が最大変位点となるように振動板の面積全体が厚み方向に屈曲変形し、面積屈曲モードで振動する。

【0018】本発明において、導電性接着剤とは導電性フィラーを含む公知の接着剤のことである。振動板をケースの支持部に固定する接着剤としては、エポキシ系接着剤のように硬化状態におけるヤング率が高く、振動板の端部を強く拘束するものでもよいし、シリコンゴムのように、硬化状態におけるヤング率が低く、振動板の拘束力が弱く、振動板の変位を許容するものであってもよい。また、振動板とケースとの隙間を封止する封止材としては、シリコンゴムのように、硬化状態におけるヤング率が低く、振動板の変位を許容できる弾性封止材がよい。

#### 【0019】

【発明の実施の形態】図1～図5は本発明の第1の実施形態である表面実装型の圧電音響部品を示す。この圧電音響部品は、受話器としての用途に適したものであり、大略、ユニモルフ型の振動板1とケース10と蓋板30とで構成されている。

【0020】振動板1は、図4に示すように、表裏面に薄膜または厚膜の電極2a、2bを有し、厚み方向に分極処理された四角形の圧電板2と、圧電板2と幅寸法が同一で長さ寸法がやや長い長方形に形成され、圧電板2の片面電極2bに導電性接着剤などを介して対面接着された金属板3とで構成されている。なお、片面電極2bは、金属板3を圧電板2の裏面に導電性接着剤などを介して直接接合することで、省略してもよい。この実施形態では、圧電板2が金属板3に対して長さ方向の一辺側へ偏った位置に接着されており、金属板3の長さ方向の他辺側には金属板3が露出した露出部3aを有する。

【0021】圧電板2としては、例えばPZTなどの圧電セラミックスが用いられる。また、金属板3は良導電性とバネ弾性とを兼ね備えた材料が望ましく、特にヤング率が圧電板2と近い材料が望ましい。そのため、例えばリン青銅、42Niなどが用いられる。なお、金属板3が42Niの場合には、セラミック(PZT等)と熱膨張係数が近いので、より信頼性の高いものが得られる。

【0022】上記振動板1はケース10内に収納されている。ケース10は図5に示すように、セラミックスまたは樹脂などの絶縁性材料で底壁部11と4つの側壁部12~15とを持つ箱型に形成され、側壁部12~15の内側には振動板1の周辺部を支持する段差状の支持部12a~15aが一体に形成されている。ケース10を樹脂で構成する場合には、LCP(液晶ポリマー)、PPS(ポリフェニレンサルファイド)、エポキシなどの耐熱樹脂が望ましい。

【0023】対向する2つの支持部12a、14aには、その上面から外部へ引き出された外部接続用の第1、第2の導電部16、17が設けられている。この実施例では、導電部16、17はケース10にインサート成形された金属端子で構成されている。特に、支持部14aに形成された導電部17には、支持部14aの上面に露出するコ字形状の接続部17aが形成されており、接続部17aに隣接して凹部18が形成されている。凹部18は余剰の導電性接着剤を逃がすためのものであり、接続部17aだけでなく支持部14aの中にまで穿設されている。上記接続部17aの中央部は、振動板1をケース10に収納した段階で、振動板1の端面より内側に位置している。接続部17aの中央部には、図5に斜線で示すように、導電性接着剤22が塗布されるが、導電性接着剤22の塗布径が約1mmの点滴状、塗布位置が振動板1の端面から約0.6mm内側である場合、凹部18の寸法は、 $a=0.85\text{mm}$ 、 $b=3\text{mm}$ 、 $c=0.2\text{mm}$ 程度としてある。また、他方の導電部16には、支持部12aの上面に露出する平坦な接続部16aが形成されている。底壁部11と1つの側壁部13との境界部には制動孔19が形成され、これと対向する側壁部15の開口縁部には放音用の溝部20が形成されている。

【0024】ケース10の第1、第1の導電部16、17の接続部16a、17a上には、図5に斜線で示すように、導電性接着剤21、22が点滴状または線状に塗布される。導電性接着剤21、22の主成分は、ウレタン、シリコン、ポリブタジエンなどで、室温での動的弾性率が1Hzで1GPa以下の弾性に富むものを用いるのが望ましい。塗布方法はディスペンス方式がよい。導電性接着剤21、22を塗布した後、振動板1はその圧電板2が底壁部11と対面するようにケース10の中に収納され、振動板1の周囲4辺が支持部12a~15

aの上に載せられる。このとき、第2の導電部17と圧電板2の他面電極2aとの間に必要量以上の導電性接着剤22が介在していると、圧電板2を第2の導電部17に押しつけた時に余剰の導電性接着剤22が振動板1の端面に回り込んで、金属板3と短絡する可能性がある。しかし、支持部14a上に設けられた第2の導電部17aを振動板1の端面より内側に位置させ、しかも第2の導電部17aに隣接して余剰の第2の導電性接着剤を逃がすための凹部18を設けてあるので、余剰の第2の導電性接着剤22は凹部18側あるいは底壁部11側へ流れこみ、振動板1の端面への導電性接着剤22の回り込みを防止できる。その結果、圧電板2の他面電極2aと金属板3とが短絡するのが防止され、第2の導電部17と圧電板2の他面電極2aとを確実に接続することができる。なお、第1の導電部16と金属板3の露出部3aとが導電性接着剤21によって接続されるが、この導電性接着剤21が第1の導電部16上に必要量以上塗布されていても問題はない。なぜなら、この導電性接着剤21が露出部3aの端面にまで回り込んでも、圧電板2の他面電極2aと短絡する恐れがないからである。

【0025】振動板1の周囲4辺は弾性封止材25で封止・固定されている(図2、図3参照)。弾性封止材25としては、振動板1の振動を阻害しないよう、シリコンゴムなどの弾性に富むものを用いるのが望ましい。弾性封止剤25は、液状のシリコンゴムをディスペンス方式で塗布したのち、硬化させて用いる。これにより、振動板1の両側の空間の間の空気漏れが確実に防止される。

【0026】上記のように振動板1を取り付けたケース10の開口部に蓋板30が、エポキシ系、ウレタン系、シリコン系、アクリル系などの公知の接着剤31を用いて接着固定される。蓋板30としては、ケース10と同様な耐熱性樹脂が望ましい。

【0027】ケース10の外部に露出する第1、第2の導電部16、17間に所定の周波数信号(交流信号または矩形波信号)を印加すれば、振動板1の長さ方向両端部あるいは周辺部がケース10に支持されているので、振動板1は長さベンディングモードあるいは面積屈曲モードで振動し、所定の音を発生することができる。音はケース10の放音用の溝部20から外部へ放出される。

【0028】上記実施形態では、振動板1の全周を弾性封止材25で封止・固定したが、振動板1の短辺側の2辺を支持部12a、14aに絶縁性接着剤で固定し、他の2辺を弾性封止材25でケース10との隙間を封止してもよい。この場合には、他の2つの支持部13a、15aは省略することができる。なお、弾性封止材25で振動板1の全周を封止・固定する場合には、振動板1の表側と裏側との間の空気漏れをより確実に防止できるとともに、1種類の材料で封止・固定できるので、組み立て作業が簡単になる。

【0029】図6、図7は本発明の第2の実施形態である圧電音響部品のケースを示す。この実施形態では、ケース10の支持部14aに設けられた第2の導電部17として、ケース10の深さ方向に屈曲した端子を用いることで、接続部17aと凹部18とを連続的に形成したものである。この場合も、接続部17aが振動板1の端面より内側に位置するので、接続部17aの上に導電性接着剤22を塗布し、その上に圧電板2の他面電極2aを押しつけたとき、余剰の導電性接着剤22は凹部18または底壁部11側へ流れる。そのため、導電性接着剤22が振動板1の端面まで回り込まず、金属板3との短絡を防止できる。

【0030】図8～図10は本発明の第3の実施形態である圧電音響部品のケースを示す。この実施形態では、ケース10の支持部14aを対向する側壁部13、15の間にかけ渡された連続的な壁状に形成し、その支持部14aの上に第2の導電部17を連続的に設け、導電部17の両端部を側壁部13、15の外面まで伸ばしたものである。この場合も、第2の導電部17が振動板1の端面より内側に位置しており、支持部14aと側壁部12との間に余剰の導電性接着剤を逃がすための溝状の凹部18が形成されている。第2の導電部17に広い面積で導電性接着剤を塗布しても、余剰の導電性接着剤は壁状の支持部14aの片側あるいは両側へ流れるので、振動板1の端面に導電性接着剤が付着することがなく、接続がより確実になる。

【0031】第2の導電部17は、図9のように直線状の端子をインサート成形した後、図10のように端子の両端部をケース10の裏面側へ折り曲げてよい。同様に、第1の導電部16も、平板状の端子をインサート成形し、端子の端部をケース10の裏面側へ折り曲げてよい。この場合には、インサート端子の形状が単純であるため、インサート成形が容易になる。

【0032】図11、図12は本発明の第4の実施形態である圧電音響部品のケースを示す。この実施形態では、ケース10の4隅部に第1、第2の導電部16、17を形成したものである。すなわち、側壁部12の内側に段差状の支持部12aを設け、その両端に第1の導電部16を形成するとともに、側壁部14の内側に段差状の支持部14aを設け、その両端に第2の導電部17を形成してある。特に、支持部14aの上面に露出する第2の導電部17の接続部17aはL字形に形成され、接続部17aと隣接して余剰の導電性接着剤を逃がすための凹部18が形成されている。この場合には、2個の導電部16および2個の導電部17がそれぞれ同電位の電極になるが、少なくとも1箇所ずつ振動板1と導通すればよいので、導通信頼性が向上するという利点がある。

【0033】本発明は上記実施形態に限定されるものではない。上記実施形態では、導電性接着剤をケースの導電部に塗布し、その上に振動板を載せることで、導電部

と振動板とを接続したが、導電性接着剤を振動板の所定箇所に塗布し、これをケースの導電部に押しつけることで接続してもよい。また、第2の導電部17に隣接して余剰の導電性接着剤を逃がすための凹部18を形成したが、第2の導電性接着剤22を薄膜状に塗布したり、あるいは粘性の高いシート状の導電性接着剤22を使用すれば、導電性接着剤の回り込みを防止できるので、必ずしも凹部18を形成する必要はない。この場合には、第2の導電部17を第1の導電部16と同様な形状とすることが可能である。また、振動板を構成する金属板および圧電板は長方形、正方形のいずれであってもよい。本発明の圧電音響部品は、表面実装型に限らず、リード端子型にも構成できる。つまり、第1、第2の導電部をリード端子で構成すればよい。本発明の圧電音響部品としては、圧電ブザー、圧電受話器、圧電スピーカ、圧電サウナ、リンガーなどがある。

#### 【0034】

【発明の効果】以上の説明で明らかなように、請求項1に記載の発明によれば、振動板をその圧電板がケースの底壁部を向くようにケースに収納したので、金属板の露出部と第1の導電部とが対面し、圧電板の他面電極と第2の導電部とが対面する。そのため、その間に導電性接着剤を介在させることにより、金属板の露出部と第1の導電部、圧電板の他面電極と第2の導電部とを対面接触できる。このように、第2の導電部と圧電板の他面電極とを絶縁材料などを跨がずに直接接続することができるので、導電性接着剤による接合信頼性が向上する。

【0035】また、請求項5に記載の発明では、金属板の露出部と第1の導電部、圧電板の他面電極と第2の導電部を電気的に接続した後で、振動板をケースに対して機械的な固定および封止を行うので、振動板と第1、第2の導電部との電気的接続が固定および封止によって影響を受けず、信頼性の高い圧電音響部品を得ることができる。

#### 【図面の簡単な説明】

【図1】本発明にかかる圧電音響部品の第1実施形態の分解斜視図である。

【図2】図1のX-X線断面図である。

【図3】図1のY-Y線断面図である。

【図4】振動板の分解斜視図である。

【図5】ケースの平面図である。

【図6】本発明にかかる圧電音響部品の第2実施形態に用いられるケースの斜視図である。

【図7】図6に示すケースの断面図である。

【図8】本発明にかかる圧電音響部品の第3実施形態に用いられるケースの斜視図である。

【図9】図8に示すケースの成形直後の斜視図である。

【図10】図8に示すケースの端子折り曲げ後の裏面側から見た斜視図である。

【図11】本発明にかかる圧電音響部品の第4実施形態



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に用いられるケースの斜視図である。

【図 12】 図 11 に示すケースの裏面側から見た斜視図である。

【図 13】 従来の圧電音響部品の断面図である。

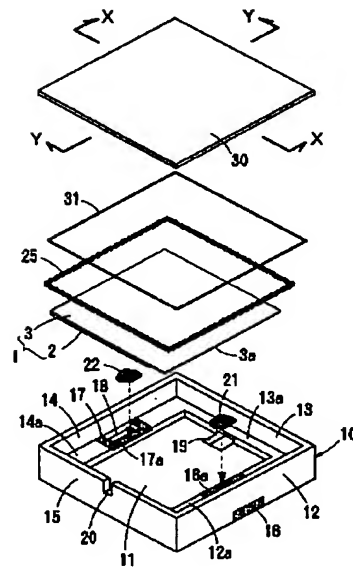
【符号の説明】

1 振動板  
2 圧電板  
2a 他面電極  
3 金属板  
10 ケース

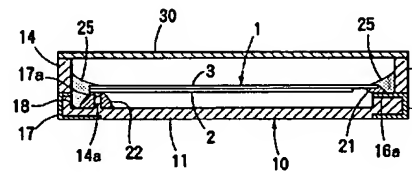
11 底壁部  
12～15 側壁部  
12a～15a 支持部  
16 第1の導電部  
17 第2の導電部  
18 凹部  
21, 22 導電性接着剤  
25 弾性封止材  
30 蓋板

10

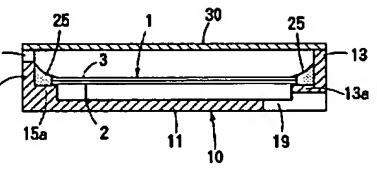
【図 1】



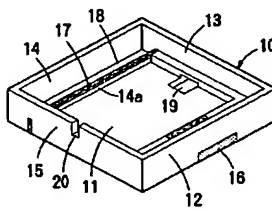
【図 2】



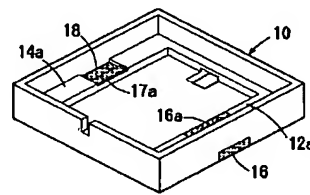
【図 3】



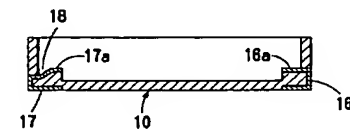
【図 8】



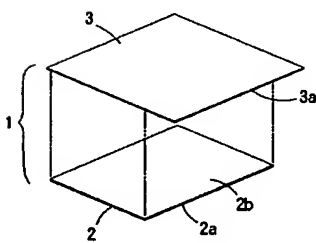
【図 6】



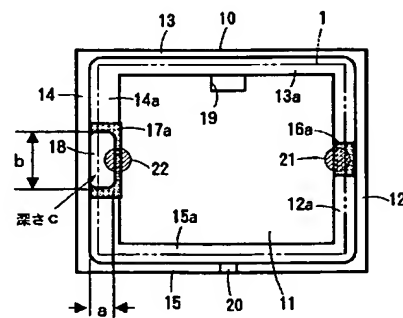
【図 7】



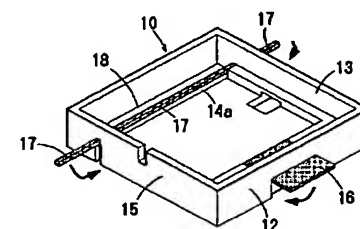
【図 4】



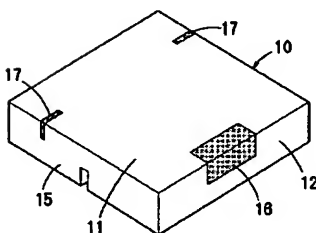
【図 5】



【図 9】

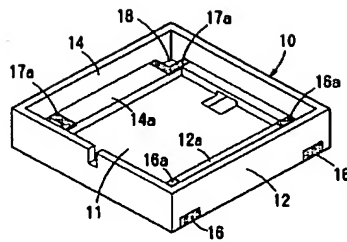


【図 10】

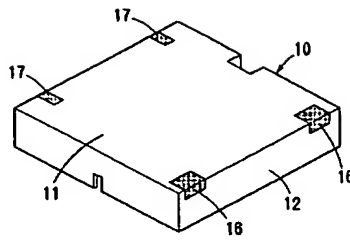




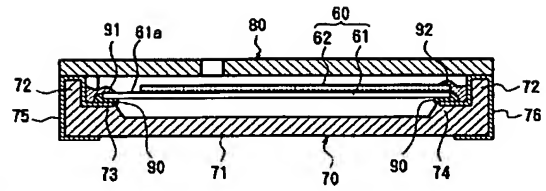
【図 11】



【図 12】



【図 13】



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032562

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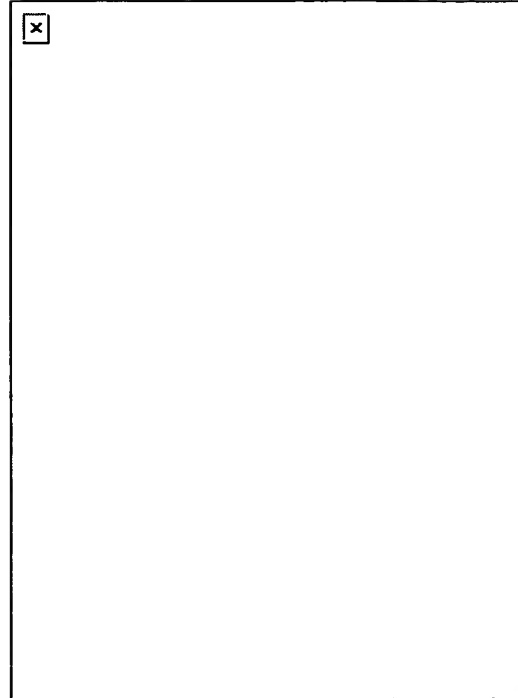
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(54) PIEZOELECTRIC ACOUSTIC PART AND METHOD FOR  
MANUFACTURING THE SAME

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a piezoelectric acoustic parts capable of improving connection reliability by directly connecting a case conducting part and a diaphragm, without a conductive adhesive straddling over insulation material.

SOLUTION: In these piezoelectric acoustic parts, a square diaphragm 1 is housed in and fixed to an insulation case 10, and the opening part of the case 10 is closed by a cover plate 30. Two facing sides of the case 10 are provided with support parts 12a and 14a and have first and second conducting parts 16 and 17, extracted from the upper face of the support parts. The diaphragm 1 is housed in the case 10, so as to make its piezoelectric plate 2 face the bottom wall part 11 side of the case 10, an exposure part 3a of a metal plate 3 is connected to the first conducting part 16 by a conductive adhesive 21 facing each other, and the electrode of the other face of the plate 2 is connected to the second conducting part 17 by a second conductive adhesive 22, facing each other.



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## LEGAL STATUS

[Date of request for examination]

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decision of rejection]

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other than the examiner's decision of  
rejection or application converted  
registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

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decision of rejection]

[Date of requesting appeal against  
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CLAIMS

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[Claim(s)]

[Claim 1] While being contained in the insulating case where it has the 1st and 2nd current carrying part which has the bottom wall section and the four side-attachment-wall sections, had a supporter inside the two side-attachment-wall sections which counter, and was pulled out from the top face of the above-mentioned supporter outside, and the above-mentioned case Two sides which counter are fixed to the above-mentioned supporter, and it has the diaphragm of the square with which the closure of the clearance between remaining two sides and cases was carried out, and the cover plate which closes opening of the

above-mentioned case. The above-mentioned diaphragm The location which inclined toward 1 side of two sides by which the one side electrode of a piezo-electric plate is fixed to one side of a metal plate by the supporter of a case is pasted. The outcrop which some metal plates expose to the other side side of the field of the metal plate which the piezo-electric plate pasted up is prepared. The 1st electroconductive glue connects and, on the other hand, this outcrop and 1st current carrying part set on the piezo-electric sound components of a piezo-electric plate to which an electrode and the 2nd current carrying part were connected by the 2nd electroconductive glue. The above-mentioned diaphragm is contained by the case so that the piezo-electric plate may turn to the bottom wall section of a case. The piezo-electric sound components with which the outcrop and the 1st current carrying part of the above-mentioned metal plate meet with the 1st electroconductive glue, and are connected, and an electrode and the 2nd current carrying part are characterized by the thing of a piezo-electric plate which it meets with the 2nd electroconductive glue and is connected on the other hand.

[Claim 2] The 2nd current carrying part prepared on the above-mentioned supporter is a piezo-electric sound component according to claim 1 characterized by being located inside the end face of the above-mentioned diaphragm, adjoining the 2nd current carrying part of the above, and preparing the crevice for missing the 2nd excessive electroconductive glue.

[Claim 3] The piezo-electric sound component according to claim 1 or 2 characterized by carrying out the closure of the clearance between remaining two sides and cases with the elastic sealing agent while two sides which the above-mentioned diaphragm counters are fixed to a supporter with an elastic sealing agent.

[Claim 4] The 1st and 2nd current carrying part of the above is a piezo-electric sound component according to claim 1 to 3 characterized by consisting of metal terminals by which insertion mold was carried out to the case.

[Claim 5] The process for which the insulating case where it has the 1st and 2nd

current carrying part which has the bottom wall section and the four side-attachment-wall sections, had a supporter inside the two side-attachment-wall sections which counter, and was pulled out from the top face of the above-mentioned supporter outside is prepared, The process for which the diaphragm of the square with which the outcrop which some metal plates expose to the other side side of the field of the metal plate which pasted up on the location which inclined toward 1 side of two sides to which the one side electrode of a piezo-electric plate counters one side of a metal plate, and the piezo-electric plate pasted up was prepared is prepared, The process for which a cover plate is prepared, and the outcrop of the 1st current-carrying-part and 2nd current-carrying-part top or a metal plate and the process of a piezo-electric plate which, on the other hand, applies the 1st and 2nd electroconductive glue on an electrode, respectively, It contains in a case. the piezo-electric plate turns to the bottom wall side of a case for the above-mentioned diaphragm -- as -- and the outcrop of a metal plate and a piezo-electric plate -- so that an electrode may correspond to the 1st current carrying part and 2nd current carrying part on the other hand, respectively While making confrontation connection of the outcrop and the 1st current carrying part of a metal plate with the 1st electroconductive glue The process of a piezo-electric plate which, on the other hand, makes confrontation connection of an electrode and the 2nd current carrying part with the 2nd electroconductive glue, The manufacture approach of piezo-electric sound components equipped with the process which fixes the outcrop of the metal plate of the above-mentioned diaphragm, this, and the side of the diaphragm which counters to the above-mentioned supporter, the process which closes the two remaining sides of the above-mentioned diaphragm to a case, and the process which fixes a cover plate to opening of the above-mentioned case.

[Claim 6] The manufacture approach of the piezo-electric sound component according to claim 5 which the crevice for adjoining the 2nd current carrying part of the above-mentioned case, and missing the 2nd excessive electroconductive glue is prepared, and are characterized by missing the 2nd excessive

electroconductive glue to the above-mentioned crevice in case [ of the above-mentioned piezo-electric plate ] an electrode and the 2nd current carrying part are connected with the 2nd electroconductive glue on the other hand.

[Claim 7] The 1st and 2nd electroconductive glue of the above is applied on the 1st current carrying part and the 2nd current carrying part, respectively. When the above-mentioned diaphragm is contained in a case, on the other hand, by pushing against the 1st and the 2nd current carrying part of the outcrop of a metal plate, and a piezo-electric plate by which the electrode was applied to electroconductive glue, respectively The manufacture approach of the piezo-electric sound component according to claim 5 or 6 which connect the outcrop and the 1st current carrying part of a metal plate, and is characterized by the thing of a piezo-electric plate for which an electrode and the 2nd current carrying part are connected on the other hand.

[Claim 8] The manufacture approach of the piezo-electric sound component according to claim 5 to 7 characterized by including the process which makes coincidence harden the 1st and 2nd electroconductive glue of the above, and the insulating adhesives or the elastic sealing agent for fixing or closing the above-mentioned diaphragm to a case.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a piezo-electric sound component and its manufacture approaches, such as a piezo-electric buzzer and a piezo-electric earphone.

[0002]

[Description of the Prior Art] Conventionally, in electronic equipment, home electronics, a portable telephone, etc., piezo-electric sound components are widely used as the piezo-electric buzzer which generates an alarm tone and a sound of operation, or a piezo-electric earphone. Its thing of the structure which closed opening of a case with covering (not shown) is common while this kind of piezo-electric sound components stick a piezo-electric circular plate on one side of a circular metal plate, constitute a uni-morph mold diaphragm, and silicone rubber is used for them and they support the periphery section of a metal plate in a circular case. However, when the circular diaphragm was used, there was a trouble that productive efficiency was bad and it was difficult for sound conversion efficiency to constitute low and small.

[0003] Then, the piezo-electric sound components which enabled improvement in productive efficiency, the improvement in sound conversion efficiency, and a miniaturization are proposed by using a square diaphragm (JP,2000-310990,A). Drawing 13 shows an example of the conventional piezo-electric sound components, and is equipped with the insulating case 70 which has the diaphragm 60 which stuck the square piezo-electric plate 62 on one side of the square metal plate 61, and the bottom wall section 71 and the four side-attachment-wall sections 72, and has supporters 73 and 74 inside the two side-attachment-wall sections 72 which counter, and the cover plate 80 which closes opening of a case 70. In a case 70, a diaphragm 60 turns the metal plate 61 at the bottom wall section 71 side of a case 70, it is contained, two sides and

supporters 73 and 74 with which a diaphragm 60 counters are fixed with adhesives or the elastic sealing agent 90, and the closure of the clearance between remaining two sides and cases 70 of a diaphragm 60 is carried out with the elastic sealing agent (not shown).

[0004] the other side side of the field which pasted up on the location where the piezo-electric plate 62 which has an electrode at the front rear face at least in one side of the metal plate 61 which constitutes a diaphragm 60 from above-mentioned piezo-electric sound components inclined toward 1 side of two sides fixed to the supporter of a case 70 ( drawing 13 right-hand side), and the piezo-electric plate 62 of a metal plate 61 pasted up -- some metal plates 61 -- 61a is exposed. The 1st and 2nd current carrying part 75 and 76 pulled out outside is formed in the supporters 73 and 74 of a case 70 from the top face, outcrop 61a of a metal plate 61 and the 1st current carrying part 75 are connected to them with electroconductive glue 91, and piezo-electric sound components consist of things of the piezo-electric plate 62 for which an electrode and the 2nd current carrying part 76 are connected with electroconductive glue 92 on the other hand.

[0005]

[Problem(s) to be Solved by the Invention] However, on the other hand, since [ of the piezo-electric plate 62 connected with the 2nd current carrying part 76 ] the electrode is close with the metal plate 61, in case it connects with electroconductive glue 92, it has the problem of being easy to connect with a metal plate 61 too hastily. therefore, the thing for which electroconductive glue 92 is applied so that the end face of a metal plate 61 may be covered with insulating adhesives or an insulating sealing agent 90 and a it top may be straddled, in order to insulate a metal plate 61 from electroconductive glue 92, while turning the metal plate 61 of a diaphragm 60 to the bottom wall section 71 side of a case 70 and fixing with the above-mentioned piezo-electric sound components -- the 2nd current carrying part 76 and the piezo-electric plate 62 -- on the other hand, the electrode is connected.

[0006] However, in the above connection methods, ranging over an adhesives

[ of insulation / electroconductive glue / 92 ], or sealing agent 90 top, in order [ of the 2nd current carrying part 76 and the piezo-electric plate 62 ] to make it flow through an electrode on the other hand, it becomes indirect connection, and there is a problem of leaving anxiety to junction dependability. If electroconductive glue 92 is especially applied on a sealing agent 90 like silicone rubber, since the fixing reinforcement of a sealing agent 90 and electroconductive glue 92 is low, dependability will become low.

[0007] Then, the purpose of this invention is to offer the piezo-electric sound components which can carry out direct continuation of the current carrying part and diaphragm of a case, and can raise junction dependability, without electroconductive glue straddling an insulating material. Other purposes are to offer the manufacture approach of the piezo-electric sound components which can connect the current carrying part and diaphragm of a case simply and certainly.

[0008]

[Means for Solving the Problem] The above-mentioned purpose is attained by invention according to claim 1 or 5. The insulating case where it has the 1st and 2nd current carrying part which invention concerning claim 1 has the bottom wall section and the four side-attachment-wall sections, had a supporter inside the two side-attachment-wall sections which counter, and was pulled out from the top face of the above-mentioned supporter outside, The diaphragm of the square with which two sides which counter were fixed to the above-mentioned supporter, and the closure of the clearance between remaining two sides and cases was carried out while being contained in the above-mentioned case, It has the cover plate which closes opening of the above-mentioned case. The above-mentioned diaphragm The location which inclined toward 1 side of two sides by which the one side electrode of a piezo-electric plate is fixed to one side of a metal plate by the supporter of a case is pasted. The outcrop which some metal plates expose to the other side side of the field of the metal plate which the piezo-electric plate pasted up is prepared. The 1st electroconductive glue connects and, on the other

hand, this outcrop and 1st current carrying part set on the piezo-electric sound components of a piezo-electric plate to which an electrode and the 2nd current carrying part were connected by the 2nd electroconductive glue. The above-mentioned diaphragm is contained by the case so that the piezo-electric plate may turn to the bottom wall section of a case. The outcrop and the 1st current carrying part of the above-mentioned metal plate meet with the 1st electroconductive glue, and are connected, and, on the other hand, an electrode and the 2nd current carrying part offer the piezo-electric sound components characterized by the thing of a piezo-electric plate which it meets with the 2nd electroconductive glue and is connected.

[0009] Moreover, the process for which the insulating case where it has the 1st and 2nd current carrying part which invention concerning claim 5 has the bottom wall section and the four side-attachment-wall sections, had a supporter inside the two side-attachment-wall sections which counter, and was pulled out from the top face of the above-mentioned supporter outside is prepared, The process for which the diaphragm of the square with which the outcrop which some metal plates expose to the other side side of the field of the metal plate which pasted up on the location which inclined toward 1 side of two sides to which the one side electrode of a piezo-electric plate counters one side of a metal plate, and the piezo-electric plate pasted up was prepared is prepared, The process for which a cover plate is prepared, and the outcrop of the 1st current-carrying-part and 2nd current-carrying-part top or a metal plate and the process of a piezo-electric plate which, on the other hand, applies the 1st and 2nd electroconductive glue on an electrode, respectively, It contains in a case. the piezo-electric plate turns to the bottom wall side of a case for the above-mentioned diaphragm -- as -- and the outcrop of a metal plate and a piezo-electric plate -- so that an electrode may correspond to the 1st current carrying part and 2nd current carrying part on the other hand, respectively While making confrontation connection of the outcrop and the 1st current carrying part of a metal plate with the 1st electroconductive glue The process of a piezo-electric plate which, on the other hand, makes

confrontation connection of an electrode and the 2nd current carrying part with the 2nd electroconductive glue, The manufacture approach of piezo-electric sound components equipped with the process which fixes the outcrop of the metal plate of the above-mentioned diaphragm, this, and the side of the diaphragm which counters to the above-mentioned supporter, the process which closes the two remaining sides of the above-mentioned diaphragm to a case, and the process which fixes a cover plate to opening of the above-mentioned case is offered.

[0010] In invention concerning claim 1, the uni-morph mold diaphragm adhered to the location where the piezo-electric plate inclined toward one side of a metal plate as a diaphragm at one side side is used. The 1st current carrying part and 2nd current carrying part which were pulled out outside are formed in the supporter of the case which fixes two sides which this diaphragm counters. A diaphragm is contained by the case so that the piezo-electric plate may turn to the bottom wall section of a case. the time of containing a diaphragm in a case -- the outcrop and the 1st current carrying part of a metal plate -- meeting -- the thing of a piezo-electric plate made for electroconductive glue to intervene between them since an electrode and the 2nd current carrying part meet on the other hand -- the outcrop and the 1st current carrying part of a metal plate -- certain -- connectable -- a piezo-electric plate -- on the other hand, an electrode and the 2nd current carrying part are certainly connectable. Thus, since the 2nd current carrying part and a piezo-electric plate can, on the other hand, make direct confrontation connection of the electrode, without straddling an insulating material etc., the junction dependability by electroconductive glue improves.

[0011] If the electroconductive glue more than an initial complement intervenes between electrodes on the other hand, when [ of the 2nd current carrying part and a piezo-electric plate ] a piezo-electric plate is pushed against the 2nd current carrying part, excessive electroconductive glue turns to the end face of a diaphragm, and may connect with a metal plate too hastily. So, in claim 2, in order to prevent a surroundings lump of electroconductive glue, the 2nd current

carrying part prepared on the supporter is located inside the end face of a diaphragm, the 2nd current carrying part is adjoined, and the crevice for missing the 2nd excessive electroconductive glue is prepared. Therefore, when [ of a piezo-electric plate ] an electrode is pushed against the 2nd current carrying part on the other hand, the 2nd excessive electroconductive glue flows into a crevice, and can prevent a surroundings lump of the electroconductive glue to the end face of a diaphragm. consequently, a piezo-electric plate -- on the other hand -- the short circuit of an electrode and a metal plate -- it can prevent -- the 2nd current carrying part and a piezo-electric plate -- on the other hand, an electrode is certainly connectable.

[0012] It is desirable to fix to a supporter two sides which a diaphragm counters with an elastic sealing agent like claim 3, and to close the clearance between remaining two sides and cases with an elastic sealing agent. That is, while an air leak is lost by closing the perimeter perimeter of a diaphragm with an elastic sealing agent, a sound pressure property also improves. Moreover, since one kind of elastic sealing agent can perform immobilization and the closure of a diaphragm, immobilization of a diaphragm and a closure activity become easy.

[0013] It is desirable to constitute the 1st and 2nd current carrying part from a metal terminal by which insertion mold was carried out to the case like claim 4. In this case, the current carrying part which serves as an external electrode can be formed easily.

[0014] On the other hand, the 1st and 2nd electroconductive glue is applied on an electrode, respectively. invention concerning claim 5 -- the outcrop of the 1st current-carrying-part and 2nd current-carrying-part top or a metal plate, and a piezo-electric plate -- while a diaphragm is contained in a case so that the piezo-electric plate may turn to the bottom wall side of a case, and forcing the outcrop of a metal plate through the 1st electroconductive glue to the 1st current carrying part -- a piezo-electric plate -- on the other hand, an electrode is pushed through the 2nd electroconductive glue to the 2nd current carrying part. therefore, the outcrop of a metal plate, the 1st current carrying part, and a piezo-electric plate --

on the other hand, confrontation connection of an electrode and the 2nd current carrying part can be made easily. Then, what is necessary is to fix to a supporter two sides which a diaphragm counters, and just to close the two remaining sides of a diaphragm to a case. That is, since mechanical immobilization and the mechanical closure are performed after connecting a diaphragm and a current carrying part electrically, the electrical installation of a diaphragm and the 1st and 2nd current carrying part is not influenced by immobilization and the closure, but dependability improves.

[0015] Like claim 7, the 1st and 2nd electroconductive glue is applied on the 1st current carrying part and the 2nd current carrying part, respectively, and the outcrop and the 1st current carrying part of a metal plate are connected by pushing against the 1st of the outcrop of a metal plate, and a piezo-electric plate by which the electrode was applied to electroconductive glue on the other hand, and the 2nd current carrying part, respectively, and it is good to, connect [ of a piezo-electric plate ] an electrode and the 2nd current carrying part on the other hand. In this case, since the spreading location of electroconductive glue is fixed, it becomes connectable [ stable ].

[0016] It is desirable to make coincidence harden the 1st and 2nd electroconductive glue, and the insulating adhesives or the elastic sealing agent for fixing or closing a diaphragm to a case like claim 8. In this case, electrical installation of immobilization or the closure of a diaphragm and a case, and a diaphragm and a current carrying part can be performed at few processes, and piezo-electric sound components can be manufactured cheaply.

[0017] As for the diaphragm of this invention, either die-length bending mode or area crookedness mode may vibrate. namely, the part by which the diaphragm was fixed to the case when two sides which a diaphragm counters were fixed to the supporter of a case and the clearance between remaining two sides and cases was closed possible [ displacement ] -- as a knot -- up and down -- deforming by flexion -- the center section of the die-length direction -- max -- a variation rate -- it vibrates in die-length bending mode so that it may become a



point. moreover -- the case where all four sides of a diaphragm are fixed to the supporter of a case -- the intersection of the diagonal line of the principal plane of a diaphragm -- max -- a variation rate -- the whole area of a diaphragm deforms by flexion in the thickness direction so that it may become a point, and it vibrates in area crookedness mode.

[0018] In this invention, electroconductive glue is the well-known adhesives containing a conductive filler. As adhesives which fix a diaphragm to the supporter of a case, the Young's modulus in a hardening condition may be high like epoxy system adhesives, the edge of a diaphragm may be restrained strongly, and like silicone rubber, the Young's modulus in a hardening condition is low, and the restraint of a diaphragm is weak and may permit the variation rate of a diaphragm. Moreover, as a sealing agent which closes the clearance between a diaphragm and a case, like silicone rubber, the Young's modulus in a hardening condition is low, and the elastic sealing agent which can permit the variation rate of a diaphragm is good.

[0019]

[Embodiment of the Invention] Drawing 1 - drawing 5 show the piezo-electric sound components of the surface mount mold which is the 1st operation gestalt of this invention. This piezo-electric sound component fits the application as an earphone, and consists of the diaphragms 1, the cases 10, and cover plates 30 of a profile and a uni-morph mold.

[0020] As shown in drawing 4 , a diaphragm 1 has electrode 2a of a thin film or a thick film, and 2b at the front rear face, and the piezo-electric plate 2, the piezo-electric plate 2, and width method of the square by which polarization processing was carried out in the thickness direction are the same, and are formed in a rectangle with a little long die-length dimension, and it is constituted from a metal plate 3 by which confrontation adhesion was carried out through electroconductive glue etc. by one side electrode 2b of the piezo-electric plate 2. In addition, one side electrode 2b is joining to the rear face of the piezo-electric plate 2 directly through electroconductive glue etc., and may omit a metal plate 3.

With this operation gestalt, the location where the piezo-electric plate 2 inclined toward the one-side side of the die-length direction to the metal plate 3 is pasted, and it has outcrop 3a which the metal plate 3 exposed in the other side side of the die-length direction of a metal plate 3.

[0021] As a piezo-electric plate 2, electrostrictive ceramics, such as PZT, is used, for example. Moreover, a metal plate 3 has the desirable ingredient which combines right conductivity and spring elasticity, and its ingredient especially with as near Young's modulus as the piezo-electric plate 2 is desirable. Therefore, phosphor bronze, 42nickel, etc. are used, for example. In addition, since ceramics (PZT etc.) and the coefficient of thermal expansion are near when a metal plate 3 is 42nickel, what has more high dependability is obtained.

[0022] The above-mentioned diaphragm 1 is contained in the case 10. A case 10 is formed in the core box which has the bottom wall section 11 and the four side-attachment-wall sections 12-15 with insulating ingredients, such as ceramics or resin, as shown in drawing 5, and the supporters 12a-15a of the shape of a level difference which supports the periphery of a diaphragm 1 inside the side-attachment-wall sections 12-15 are formed in one. When it constitutes a case 10 from resin, heat-resistant resin, such as LCP (liquid crystal polymer), PPS (polyphenylene sulfide), and epoxy, is desirable.

[0023] The 1st and 2nd current carrying part 16 and 17 for external connection pulled out from the top face outside is formed in two supporters 12a and 14a which counter. Current carrying parts 16 and 17 are constituted from this example by the metal terminal by which insert molding was carried out to the case 10. Connection 17a of the shape of a KO typeface exposed to the top face of supporter 14a is formed especially in the current carrying part 17 formed in supporter 14a, connection 17a is adjoined and the crevice 18 is formed. A crevice 18 is for missing excessive electroconductive glue, and is drilled even not only in connection 17a but in supporter 14a. The center section of the above-mentioned connection 17a is the phase which contained the diaphragm 1 in the case 10, and is located inside the end face of a diaphragm 1. As a slash shows

to drawing 5 , electroconductive glue 22 is applied to the center section of connection 17a, but when the letter of intravenous drip and spreading location whose diameter of spreading of electroconductive glue 22 is about 1mm are about 0.6mm inside from the end face of a diaphragm 1, the dimension of a crevice 18 is set to  $a = 0.85\text{mm}$ ,  $b = 3\text{mm}$ , and about  $c = 0.2\text{mm}$ . Moreover, flat connection 16a exposed to the top face of supporter 12a is formed in the current carrying part 16 of another side. The braking hole 19 is formed in the boundary section of the bottom wall section 11 and the one side-attachment-wall section 13, and the slot 20 for sound emission is formed in the opening edge of this and the side-attachment-wall section 15 which counters.

[0024] As a slash shows at drawing 5 on connection 16a of the 1st and 1st current carrying part 16 and 17 of a case 10, and 17a, electroconductive glue 21 and 22 is applied to the letter of intravenous drip, or a line. The principal components of electroconductive glue 21 and 22 are urethane, silicone, polybutadiene, etc., and it is desirable to use that to which the dynamic modulus in a room temperature is rich in the elasticity of 1 or less GPa by 1Hz. The dispensing method of the method of application is good. After applying electroconductive glue 21 and 22, a diaphragm 1 is contained in a case 10 so that the piezo-electric plate 2 may meet the bottom wall section 11, and four sides of perimeters of a diaphragm 1 are carried on Supporters 12a-15a. At this time, if the electroconductive glue 22 more than an initial complement intervenes between electrode 2a on the other hand, when [ of the 2nd current carrying part 17 and the piezo-electric plate 2 ] the piezo-electric plate 2 is pushed against the 2nd current carrying part 17, the excessive electroconductive glue 22 turns to the end face of a diaphragm 1, and may connect with a metal plate 3 too hastily. However, since the crevice 18 for locating 2nd current-carrying-part 17a prepared on supporter 14a inside the end face of a diaphragm 1, adjoining 2nd current-carrying-part 17a moreover, and missing the 2nd excessive electroconductive glue is formed, the 2nd excessive electroconductive glue 22 flows into the crevice 18 or bottom wall section 11 side, and can prevent a

surroundings lump of the electroconductive glue 22 to the end face of a diaphragm 1. consequently, it prevents that electrode 2a and a metal plate 3 short-circuit [ of the piezo-electric plate 2 ] on the other hand -- having -- the 2nd current carrying part 17 and the piezo-electric plate 2 -- on the other hand, electrode 2a is certainly connectable. In addition, although the 1st current carrying part 16 and outcrop 3a of a metal plate 3 are connected by electroconductive glue 21, it is satisfactory even if this electroconductive glue 21 is applied more than the initial complement on the 1st current carrying part 16. Although this electroconductive glue 21 turns even to the end face of outcrop 3a, it is because there is no possibility of the piezo-electric plate 2 of on the other hand connecting with electrode 2a too hastily.

[0025] The closure and immobilization of four sides of perimeters of a diaphragm 1 are done with the elastic sealing agent 25 (refer to drawing 2 and drawing 3 ). As an elastic sealing agent 25, it is desirable to use what is rich in the elasticity of silicone rubber etc. so that vibration of a diaphragm 1 may not be checked. After applying liquefied silicone rubber by the dispensing method, the elastic encapsulant 25 is stiffened and is used. Thereby, the air leak between the space of the both sides of a diaphragm 1 is prevented certainly.

[0026] A cover plate 30 uses the well-known adhesives 31, such as an epoxy system, an urethane system, a silicone system, and acrylic, for opening of the case 10 which attached the diaphragm 1 as mentioned above, and adhesion immobilization is carried out. As a cover plate 30, the same heat resistant resin as a case 10 is desirable.

[0027] If predetermined signalling frequency (an AC signal or square wave signal) is impressed between the 1st and 2nd current carrying part 16 exposed to the exterior of a case 10, and 17, since the die-length direction both ends or periphery of a diaphragm 1 is supported by the case 10, a diaphragm 1 can vibrate in die-length bending mode or area crookedness mode, and can generate a predetermined sound. A sound is emitted to the exterior from the slot 20 for the sound emission of a case 10.

[0028] With the above-mentioned operation gestalt, although the closure and immobilization of the perimeter of a diaphragm 1 were done with the elastic sealing agent 25, two sides by the side of the shorter side of a diaphragm 1 may be fixed to Supporters 12a and 14a with insulating adhesives, and the clearance between cases 10 may be closed for other two sides with the elastic sealing agent 25. In this case, other two supporters 13a and 15a are omissible. In addition, with the elastic sealing agent 25, since it makes the perimeter of a diaphragm 1 the closure and immobilization with one kind of ingredient while being able to prevent more certainly the air leak between the side front of a diaphragm 1, and a background in fixing, the closure and, an assembly activity becomes easy.

[0029] Drawing 6 and drawing 7 show the case of the piezo-electric sound components which are the 2nd operation gestalt of this invention. With this operation gestalt, connection 17a and a crevice 18 are continuously formed by using the terminal crooked in the depth direction of a case 10 as the 2nd current carrying part 17 prepared in supporter 14a of a case 10. Since connection 17a is located inside the end face of a diaphragm 1 also in this case, electroconductive glue 22 is applied on connection 17a, and when [ of the piezo-electric plate 2 ] electrode 2a is forced on the other hand, the excessive electroconductive glue 22 flows to the crevice 18 or bottom wall section 11 side on it. Therefore, electroconductive glue 22 does not turn to the end face of a diaphragm 1, and can prevent a short circuit with a metal plate 3.

[0030] Drawing 8 - drawing 10 show the case of the piezo-electric sound components which are the 3rd operation gestalt of this invention. With this operation gestalt, supporter 14a of a case 10 is formed in the shape of [ which was applied and passed among the side-attachment-wall sections 13 and 15 which counter / continuous ] a wall, the 2nd current carrying part 17 is continuously formed on that supporter 14a, and the both ends of a current carrying part 17 are lengthened to the external surface of the side-attachment-wall sections 13 and 15. Also in this case, the 2nd current carrying part 17 is

located inside the end face of a diaphragm 1, and the groove crevice 18 for missing excessive electroconductive glue is formed between supporter 14a and a side attachment wall 12. Even if it applies electroconductive glue to the 2nd current carrying part 17 in a large area, since excessive electroconductive glue flows to wall-like one side or the both sides of supporter 14a, electroconductive glue does not adhere to the end face of a diaphragm 1, and connection becomes more certain.

[0031] The 2nd current carrying part 17 may bend the both ends of a terminal to the rear-face side of a case 10 like drawing 10 , after carrying out insert molding of the straight-line-like terminal like drawing 9 . Similarly, the 1st current carrying part 16 may also carry out insert molding of the plate-like terminal, and may bend the edge of a terminal to the rear-face side of a case 10. In this case, since the configuration of an insertion terminal is simple, insert molding becomes easy.

[0032] Drawing 11 and drawing 12 show the case of the piezo-electric sound components which are the 4th operation gestalt of this invention. With this operation gestalt, the 1st and 2nd current carrying part 16 and 17 is formed in four corners of a case 10. That is, while preparing level difference-like supporter 12a inside the side-attachment-wall section 12 and forming the 1st current carrying part 16 in the both ends, level difference-like supporter 14a is prepared inside the side-attachment-wall section 14, and the 2nd current carrying part 17 is formed in the both ends. Especially connection 17a of the 2nd current carrying part 17 exposed to the top face of supporter 14a is formed in L typeface, and the crevice 18 for adjoining connection 17a and missing excessive electroconductive glue is formed. In this case, although two current carrying parts 16 and two current carrying parts 17 become the electrode of this potential, respectively, since what is necessary is just to flow through at least one place at a time with a diaphragm 1, there is an advantage that flow dependability improves.

[0033] This invention is not limited to the above-mentioned operation gestalt. Although the current carrying part and the diaphragm were connected with the above-mentioned operation gestalt by applying electroconductive glue to the

current carrying part of a case, and carrying a diaphragm on it, electroconductive glue may be applied to the predetermined part of a diaphragm, and you may connect by forcing this on the current carrying part of a case. Moreover, although the crevice 18 for adjoining the 2nd current carrying part 17 and missing excessive electroconductive glue was formed, if the 2nd electroconductive glue 22 is applied in the shape of a thin film or the electroconductive glue 22 of the viscous shape of a high sheet is used, since a surroundings lump of electroconductive glue can be prevented, it is not necessary to necessarily form a crevice 18. In this case, it is possible to make the 2nd current carrying part 17 into the same configuration as the 1st current carrying part 16. Moreover, the metal plate and the piezo-electric plate which constitute a diaphragm may be any of a rectangle and a square. The piezo-electric sound components of this invention can be constituted not only in a surface mount mold but in a lead terminal mold. That is, what is necessary is for the 1st and 2nd current carrying part just to consist of lead terminals. As piezo-electric sound components of this invention, there are a piezo-electric buzzer, a piezo-electric earphone, a piezoelectric loudspeaker, a piezo-electric sounder, a ringer, etc.

[0034]

[Effect of the Invention] since the diaphragm was contained in the case by the above explanation according to invention according to claim 1 so that the piezo-electric plate might turn to the bottom wall section of a case so that clearly -- the outcrop and the 1st current carrying part of a metal plate -- meeting -- a piezo-electric plate -- on the other hand, an electrode and the 2nd current carrying part meet. therefore, the thing made for electroconductive glue to intervene between them -- the outcrop of a metal plate, the 1st current carrying part, and a piezo-electric plate -- on the other hand, confrontation connection of an electrode and the 2nd current carrying part is made. Thus, since a piezo-electric plate can, on the other hand, carry out direct continuation of the electrode to the 2nd current carrying part, without straddling an insulating material etc., the junction dependability by electroconductive glue improves.



[0035] Moreover, in invention according to claim 5, since mechanical immobilization and the mechanical closure are performed for a diaphragm to a case after [ the outcrop of a metal plate, the 1st current carrying part, and a piezo-electric plate ], connecting the 2nd current carrying part with an electrode electrically on the other hand, by immobilization and the closure, the electrical installation of a diaphragm and the 1st and 2nd current carrying part cannot be influenced, but can obtain reliable piezo-electric sound components.

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[Translation done.]

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is the decomposition perspective view of the 1st operation gestalt of the piezo-electric sound components concerning this invention.

[Drawing 2] It is X-X-ray sectional view of drawing 1 .

[Drawing 3] It is the Y-Y line sectional view of drawing 1 .

[Drawing 4] It is the decomposition perspective view of a diaphragm.

[Drawing 5] It is the top view of a case.

[Drawing 6] It is the perspective view of the case used for the 2nd operation gestalt of the piezo-electric sound components concerning this invention.

[Drawing 7] It is the sectional view of the case shown in drawing 6 .

[Drawing 8] It is the perspective view of the case used for the 3rd operation gestalt of the piezo-electric sound components concerning this invention.

[Drawing 9] It is a perspective view immediately after shaping of the case shown in drawing 8 .

[Drawing 10] It is the perspective view seen from the rear-face side after terminal bending of the case shown in drawing 8 .

[Drawing 11] It is the perspective view of the case used for the 4th operation gestalt of the piezo-electric sound components concerning this invention.

[Drawing 12] It is the perspective view seen from the rear-face side of the case shown in drawing 11 .

[Drawing 13] It is the sectional view of the conventional piezo-electric sound components.

[Description of Notations]

1 Diaphragm

2 Piezo-electric Plate

2a On the other hand, it is an electrode.

3 Metal Plate

10 Case

11 Bottom Wall Section

12-15 Side-attachment-wall section

12a-15a Supporter

16 1st Current Carrying Part

17 2nd Current Carrying Part

18 Crevice

21 22 Electroconductive glue

25 Elastic Sealing Agent

30 Cover Plate

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[Translation done.]

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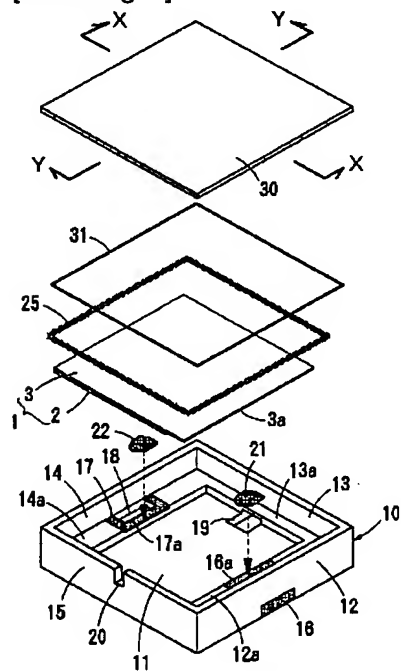
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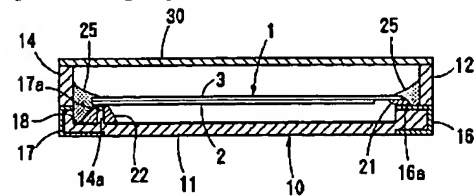
DRAWINGS

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[Drawing 1]

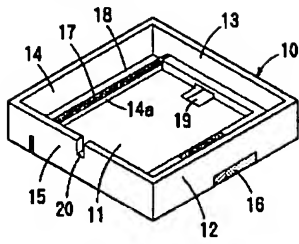


[Drawing 2]

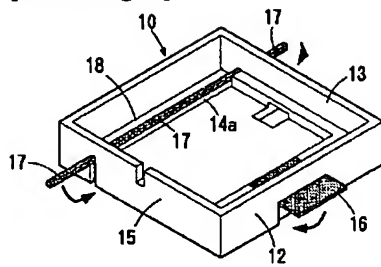




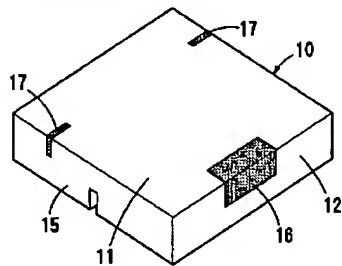
[Drawing 8]



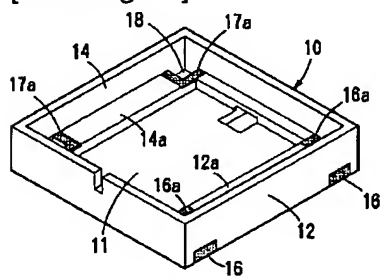
[Drawing 9]



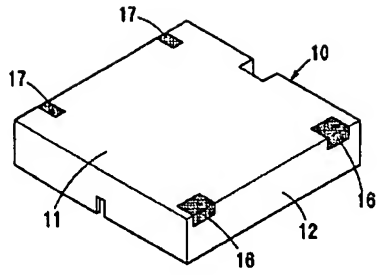
[Drawing 10]



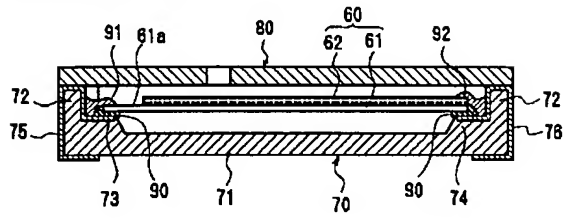
[Drawing 11]



[Drawing 12]



[Drawing 13]




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[Translation done.]